Sanbar® 20
Hollow drill steel
Datasheet

Sanbar® 20 is a high-strength chromium-molybdenum steel with high fatigue strength and excellent wear resistance in the as-rolled condition.

Chemical composition (nominal)

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C	Si	Mn	P	S	Cr	Mo
0.97	0.2	0.3	≤0.025	≤0.020	1.0	0.2

Applications

Integral drill steels primarily (pilot rods and tapered rods).

Forms of supply

Hollow drill steel is supplied as hollow, hot-rolled, round or hexagon bar. The ends are trimmed square to within 1% of the OD.

Surface condition and protection

Both the outer and inner surfaces are free from harmful slag marks, cracks and scratches. The maximum depth of defects is 0.20 mm (0.008 in.) on the outer surface and 0.15 mm (0.006 in.) on the inner surface.

The outer surface can be supplied dry or oiled for protection against corrosion during transportation. The flushing holes are normally sealed with plastic caps.

Straightness

Maximum deviation is 1 mm per 1000 mm (0.04 in. per 39.4 in.).

Fixed lengths

Fixed lengths can be supplied upon request. The length tolerance for fixed lengths are:

Lengths, mm (in.)	Tolerance, mm (in.)
≤ 3375 (132.87)	+/- 2 (0.0787)
3376-5750 (132.91-226.38)	+/- 3 (0.1181)
> 5750 (226.38)	+/- 4 (0.1575)

Bars are supplied in standard bundles containing max 1500 kg (3300 lbs).

Mechanical properties

As-delivered condition, typical values

Proof strength	Tensile strength	Hardness
$R_{p0.2}$	R_m	HRC
MPa (ksi)	MPa (ksi)	
850 (123)	1300 (189)	35-43

Decarburization

The maximum permissible decarburization depth is 0.20 mm (0.008 in.) on the outer surface and 0.10 mm (0.004 in.) on the inner surface.

Machining

Machining may require prior annealing.

Forging

Induction heating to 1000–1100°C (1830– 2010°F), 10–20 seconds. Cooling in air. Forging range 1100–850°C (2010–1560°F).

Read more about forging of Sanbar® 20 under Fabrication.

Heat treatment

Annealing (induction heating) 850–900°C (1560–1650°F). Cooling in air.
Read more about heat treatment of Sanbar® 20 under Fabrication.

Normalizing (induction heating)

950–1050°C (1740- 1920°F). Cooling in air. Hardening of shank end (through hardening). Read more about shank end hardening of Sanbar® 20 under Fabrication.

Hardening

Induction heating to 1000–1100°C (1830- 2010°F). Forced cooling in air or oil.

Tempering

Recommended hardness 50 HRC, temperature appr. 500°C (930°F)/0.5 hours. Tempering within one hour after hardening.

Fabrication

Forging

Sanbar® 20 requires rapid heating to the forging temperature and, above all, the soaking time at full temperature should be as short as possible. This will minimize grain growth and decarburization, both of which drastically impair the fatigue strength.

The design of the shank and the forging of the collar are very important to the properties and performance of the drill rod. Abrupt changes in cross-section and forging defects cause stress concentrations that can severely diminish the performance of the rod and give rise to fracture. It is therefore vital that the radius between the collar and the rod is generous and defects such as laps, folds and cracks are avoided.

Heat the rod end locally to the correct forging temperature. Forge within the temperature range specified for Sanbar® 20, and terminate at the lower end of the temperature range. This will restrict grain growth. Forge the collar using a mandrel in the flushing hole, so that the flushing tube will not close up during forging.

Shank end hardening

The shank must be hardened after forging and machining to obtain the strength necessary for robust service. Local hardening always gives rise to a soft zone at the transition between the heated and the unheated part of the rod. This results in a lower hardness in this zone, which becomes the weakest part of the rod. Hardness in the transition zone should, therefore, be maintained at as high a level as possible. The use of induction heating to produce a high transition zone hardness level is recommended.

The heated zone should overlap the previously heated zone by about 25 mm (0.984 in.). It is also important to ensure that this zone does not coincide with the part of the rod where there are maximum stresses. Experience has shown that the soft zone should be as close as possible to the collar.

Due to a brittle microstructure after hardening, it is vital to temper the component as soon as possible according to the recommendations above. Sanbar® 20 is not suitable for case hardening.

Brazing

The resulting transition zone due to local heating should be treated as above. It is very important to avoid interaction between transition zones and geometrical notches.

Shot peening

Shot peening of an adequate intensity and coverage is recommended. It improves fatigue strength due to:

- Introduced compressive stresses
- Increased hardness
- Smoother surface defects

Corrosion protection

Corrosion of a material subjected to fluctuating loads accelerates the fatigue process. In underground applications, particularly, products should be protected to avoid premature fatigue breakages starting from the hole surface.

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